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Matt Harvazinski, Venke Sankaran, Doug Talley

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AFRL/RQRE
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Edwards AFB CA 93524-7160

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AFRL/RQR
5 Pollux Drive.
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Aerospace Systems Technical Research Operation Services

Industry Day

8 July 2014

Contracting Presenter – Aimee Helm, AFTC/PZRB

Technical Presenter – Robert Shah, AFRL/RQRO

Agenda

0800 – 0815	Meet and Greet Social
0815 – 0845	Edwards Research Site Overview
0845 – 0900	Identification of Key AF Personnel
0900 – 0915	Business Information
0915 – 0930	Break
0930 – 1000	Technical Information
1000 – 1030	Q&A
1030 – 1100	Tour 1/Individual Q&A Sessions
1100 – 1200	Lunch
1200 – 1230	Tour 2/Individual Q&A Sessions
1230 – 1500	Individual Q&A Sessions (as needed)

Industry Day

- **Aerospace Systems Technical Research Operations Services (ASTROS)**
- **Vision: Obtain affordable and responsive buildup / modification of rocket test stands and facility operations for demonstrating next generation rocket propulsion technologies**
- **Early Industry Involvement**
  - **Encourage competition**
  - **Feedback from industry**

GOVERNMENT TEAM POC's

- **Procuring Contract Officer**
  - **Judy A Gayler, judy.gayler@us.af.mil 661-277-7748**
  - **Aimee Helm, aimee.helm@us.af.mil 661-277-2101**
- **Contract Specialists**
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- **Acquisition Project Manager**
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- **Deputy Acquisition Project Manager**
  - **Robert Shah, robert.shah.2@us.af.mil 661-275-5915**

Air Force Research Laboratory
Edwards Air Force Base, CA

Edwards Research Site Overview
for ASTROS Industry Day

Mr. Michael Huggins
Chief, Rocket Propulsion Division

AFMC Mission Goals

Continue to Strengthen AFMC's Role in the Nuclear Enterprise

Advance Today's & Tomorrow's Combat Capabilities through Leading-Edge Technology

Acquire and Support War-Winning Capabilities

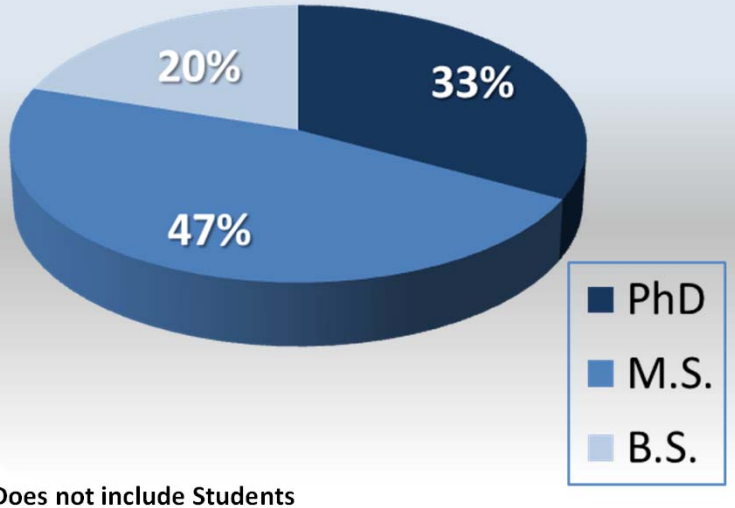
Perform World-Class Test and Evaluation

Sustain Air Force Capabilities through World-Class Depot Maintenance & Supply

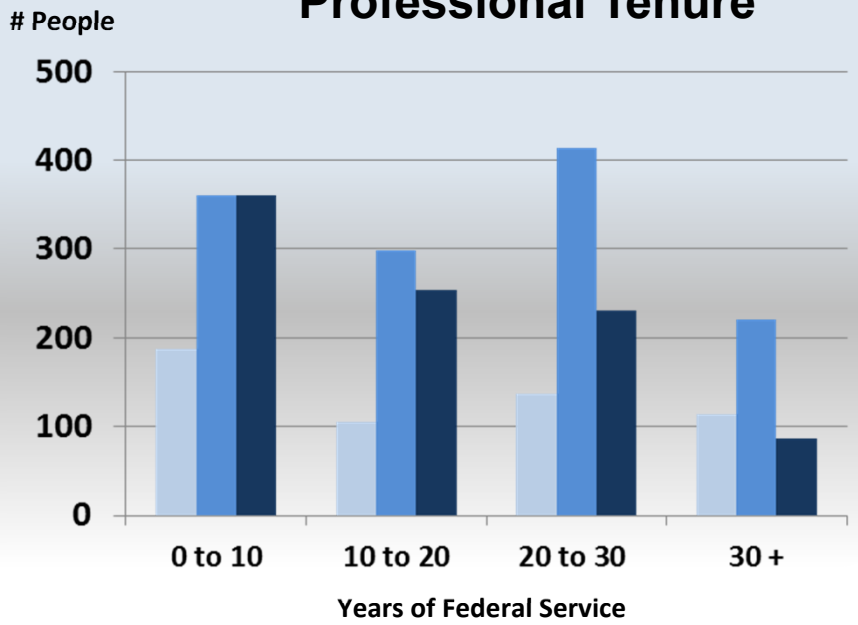
AF S&T Workforce (AFRL)

	Employees	Civilian *	Military	Contractor
Total	10,000	4,651	1,340	4,009
S&Es	6,179	2,774	746	2,659

S&E Education



Professional Tenure



* Does not include Students
* Data as of: 31 August 2013

AFRL Technical Competencies

AF Office of Scientific Research
- Aerospace, Chemical & Material Sciences
- Education & Outreach
- Mathematics, Information, & life sciences
- Physics & Electronics

Aerospace Systems
- Air Vehicles
- Control, Power & Thermal Management
- High Speed Systems
- Space & Missile Propulsion
- Turbine Engines

Directed Energy
- Directed Energy & EO for Space Superiority
- High Power Electromagnetics
- Laser Systems
- Weapons Modeling and Simulation

Information
- Autonomy, C2, & Decision Support
- Connectivity & Dissemination
- Cyber Science & Technology
- Processing & Exploitation

Human Performance
- Bio-effects
- Decision Making
- Human Centered ISR
- Training

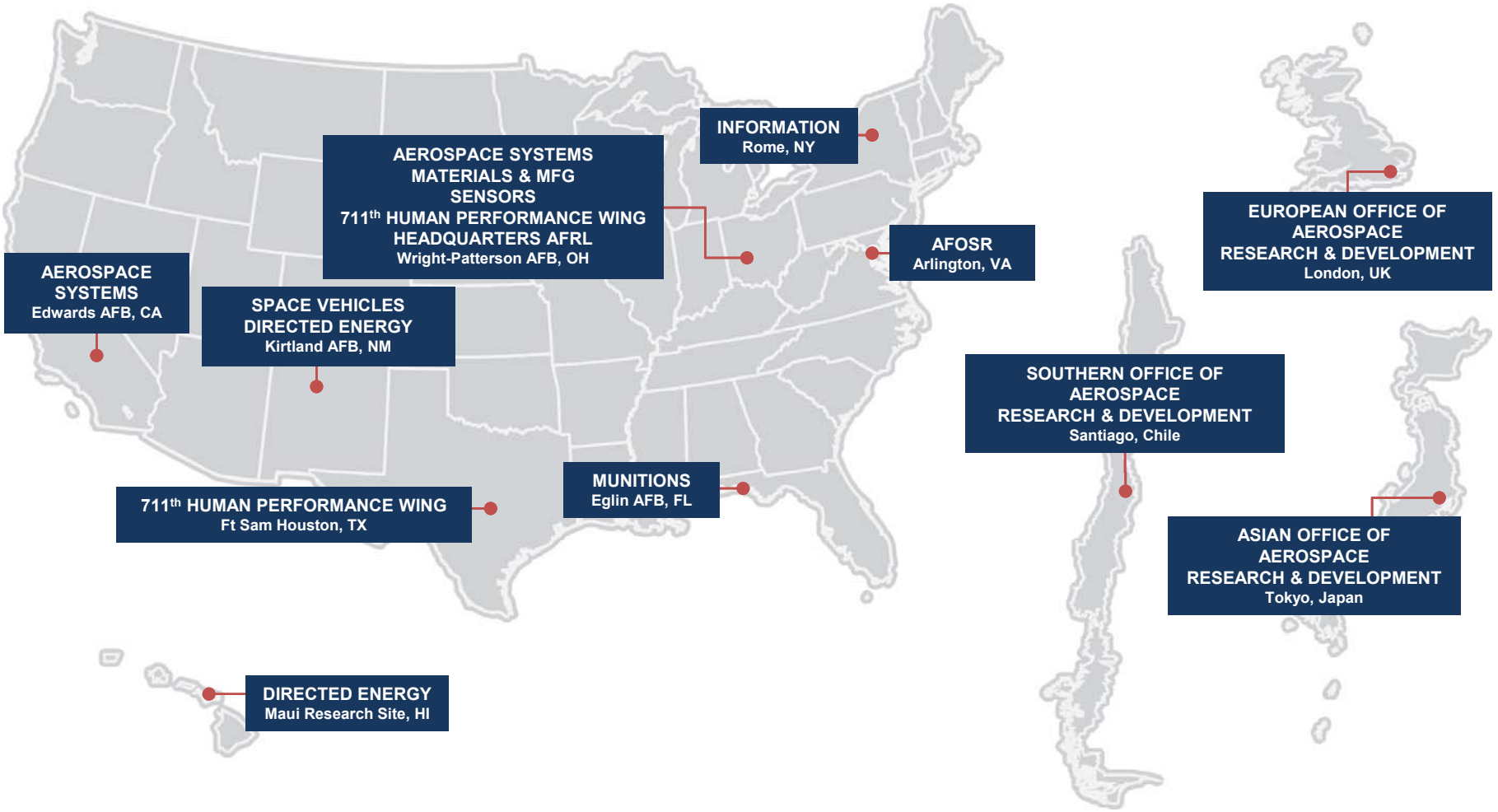
Munitions
- Fuze Technology
- Munitions AGN&C
- Munitions System Effects Science
- Ordinance Sciences
- Terminal Seeker Sciences

Sensors
- Advanced Devices & Components
- Layered Sensing Exploitation
- Multi-Int Sensing (RF/EO)
- Spectrum Warfare

Space Vehicles
- Space Electronics
- Space Environmental Impacts & Mitigation
- Space OE/IR
- Space Experiments
- Platforms & Operations Technologies

Materials and Manufacturing
- Functional Materials & Applications
- Manufacturing & Industrial Technology
- Structural Materials & Applications
- Support for Operations

AFRL Locations

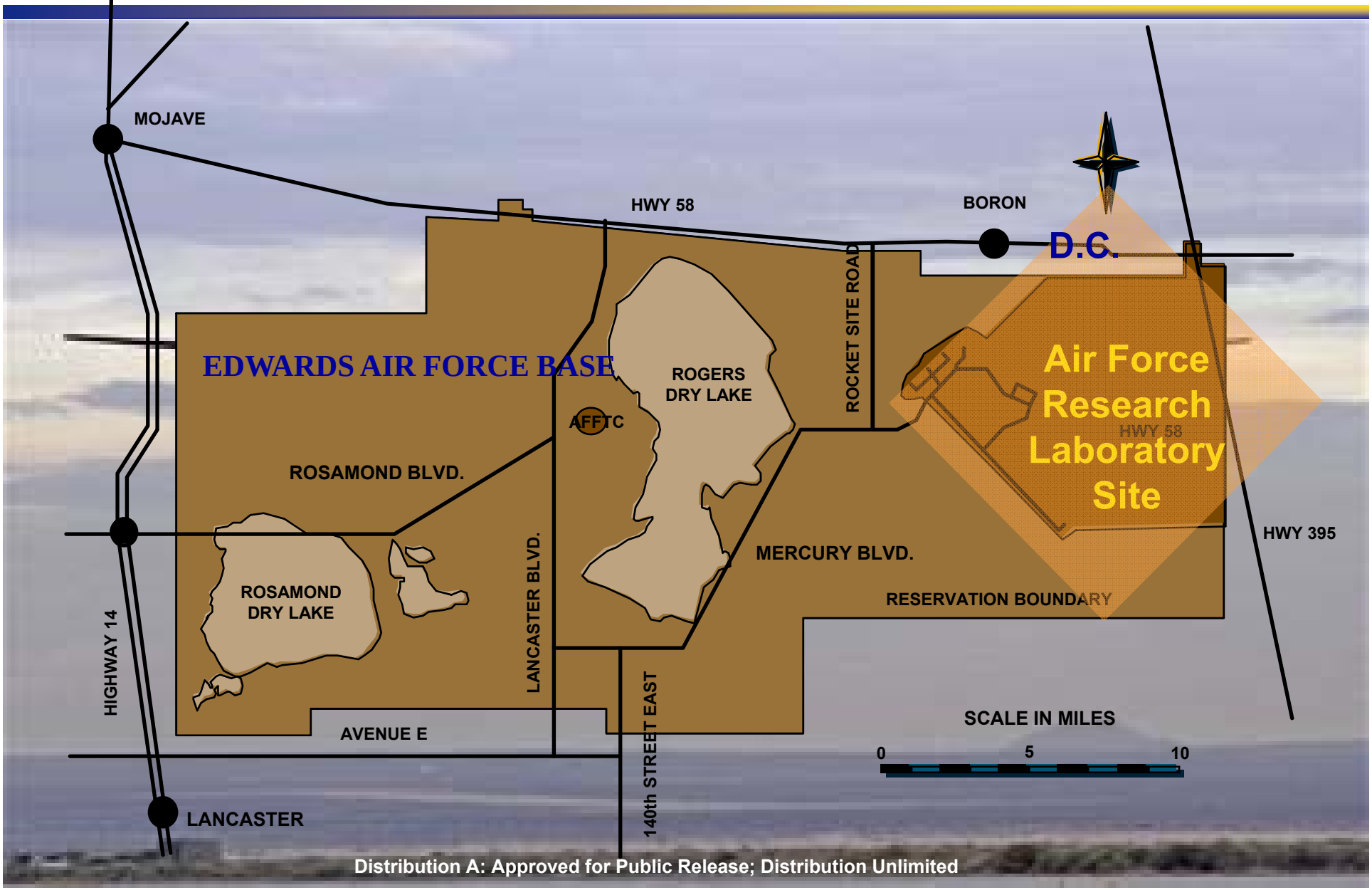


Where We Fit In

- Rocket Engines & Motors
- Satellite Propulsion
- Advanced Propulsion
- Fuels and Propellants
- System Analysis

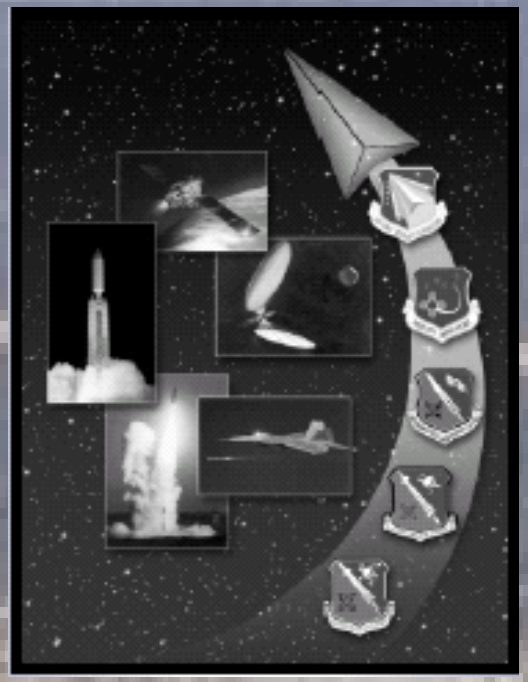
- Air Vehicle Structures
- Controls
- Turbine Engines
- Ramjet Engines
- Hypersonic Engines
- Aircraft Power
- Thermal Management
- Fuels and Propellants
- System Analysis

Edwards AFB



Edwards Site: Unique Capability

- **65 Square Mile Development Facility**
  - Air quality constraints do not inhibit research activities
  - Noise abatement not a problem
  - Wind/population corridor does not inhibit research
  - Environmental monitor/control systems in place
  - Flight Test Center relation/support ongoing
- **135 Major Lab/Engineering Facilities & Buildings**
- **30 Major Active Areas and Stands**
  - High Thrust Facilities
    - 19 Liquid Engine stands (up to 8M lbs thrust)
    - 13 Solid Rocket Motor pads (up to 10M lbs thrust)
  - Altitude Facilities (micro-newtons to 50K lbs thrust)
- **Unique geophysical set-up ($2.5B+ investment)**

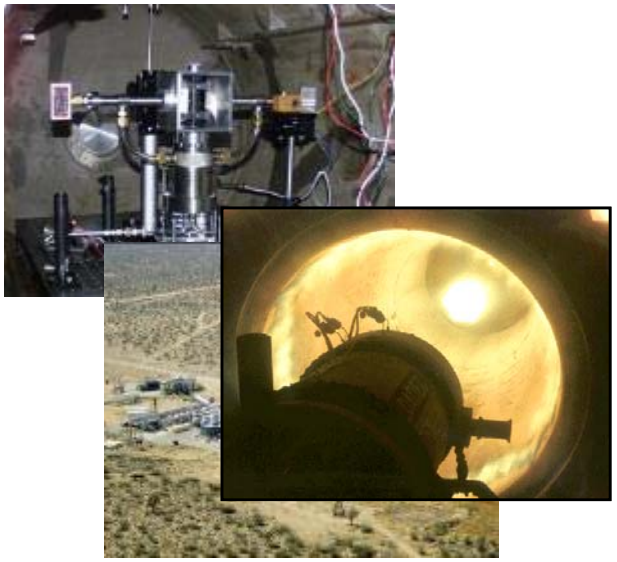


Facilities

Bench-level Labs

Altitude Facilities

- From micro-newtons to 50,000 lbs thrust



High Thrust Facilities

- 19 Liquid Engine stands, up to 8,000,000 lbs thrust
- 13 Solid Rocket Motor pads, up to 10,000,000 lbs thrust

History of the Rock

- **AF Atlas ICBM/Launch Vehicle**
  - **Early 1960s on Test Stand 1-95**

Air Force photo

Atlas intercontinental ballistic missile

History of the Rock

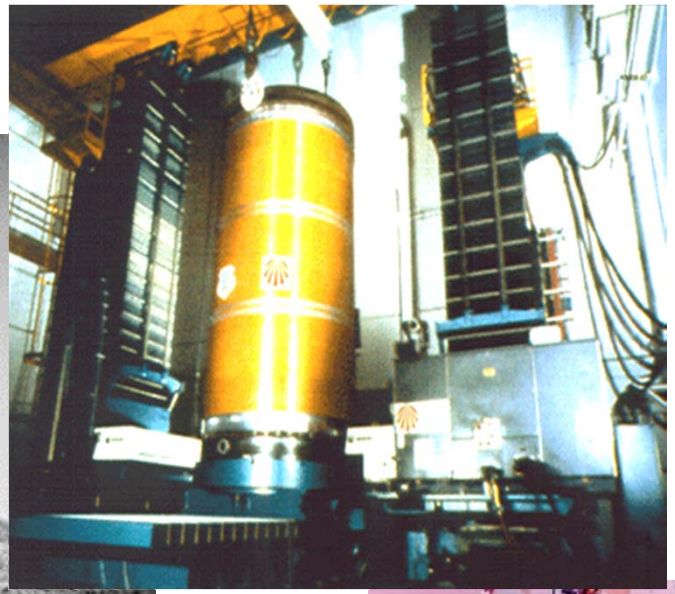
- **Titan I & II ICBM**
  - **Test Stand 1-3 in Early 1960s**
- **Titan IV solid rocket booster**
  - **1980s – 1990s in Area 1-32 and Test Stand 1-B**

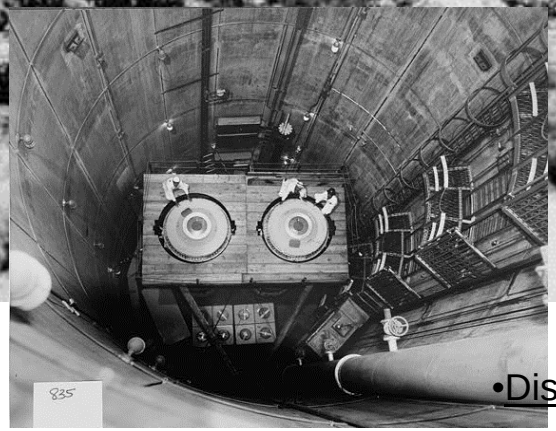
History of the Rock

- **F-1 engine testing for the Saturn V Rocket that put Men on the Moon**

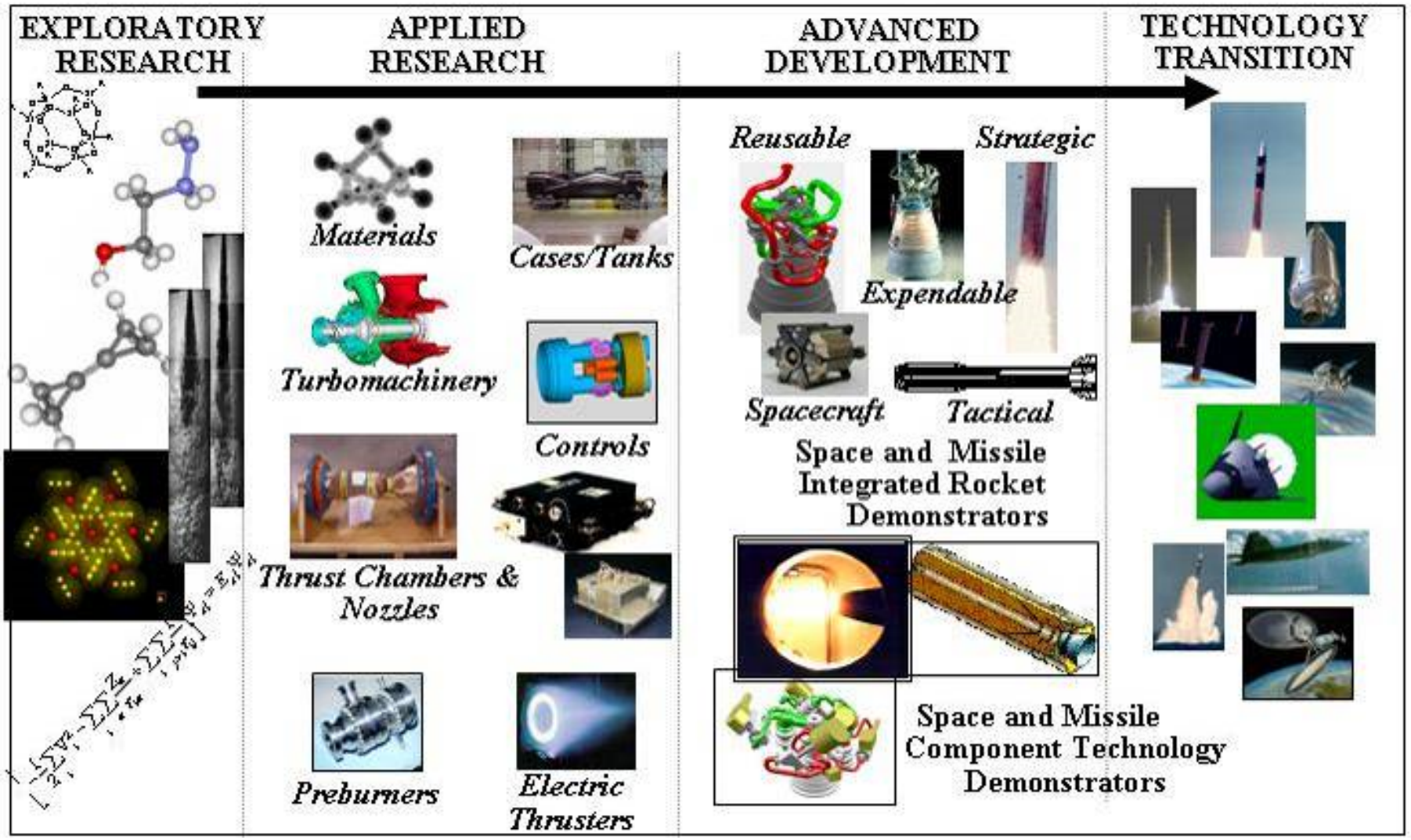
History of the Rock

- **AF Minuteman I, II and III ICBMs**

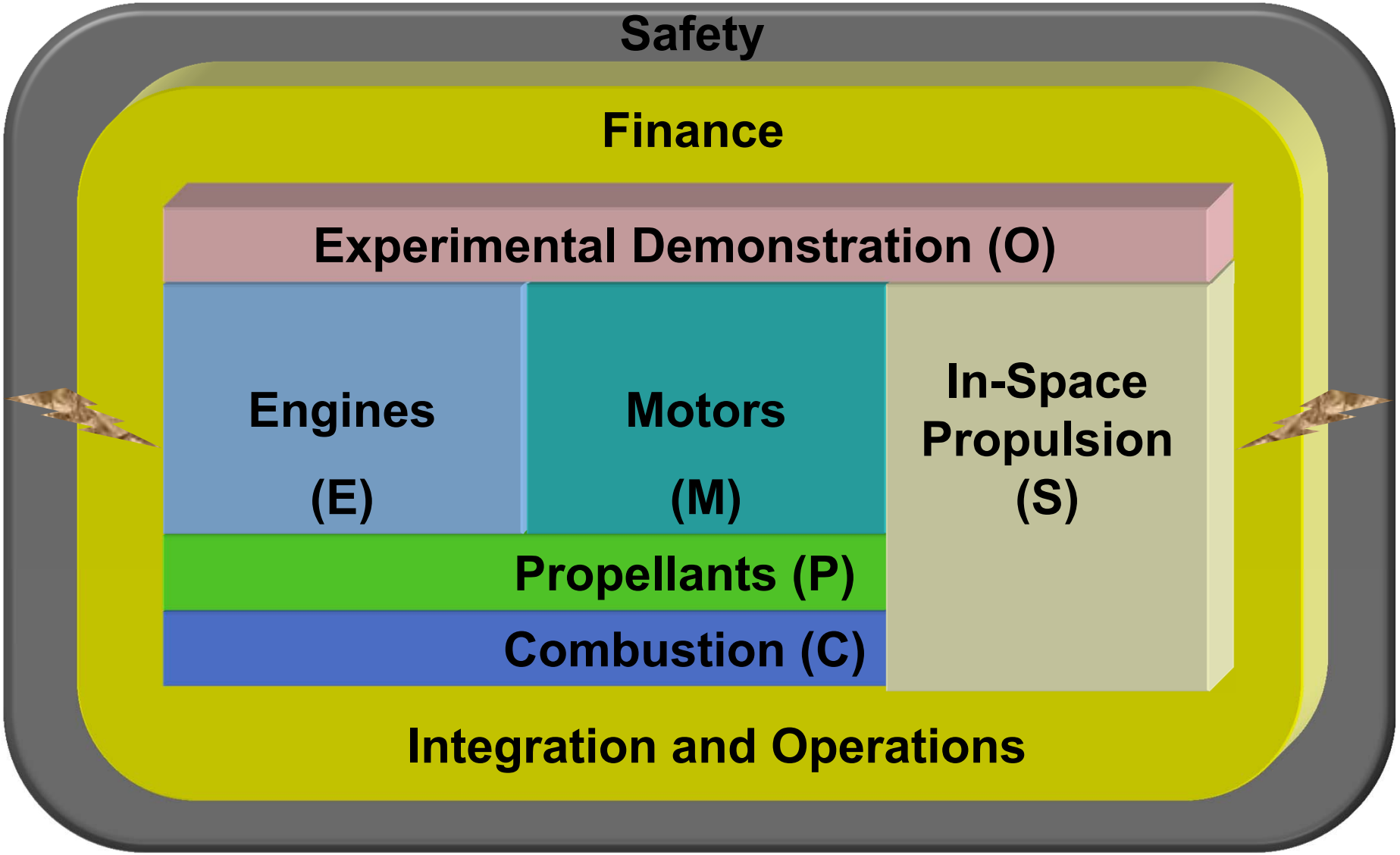




Space and Missile R&D Building Block Process



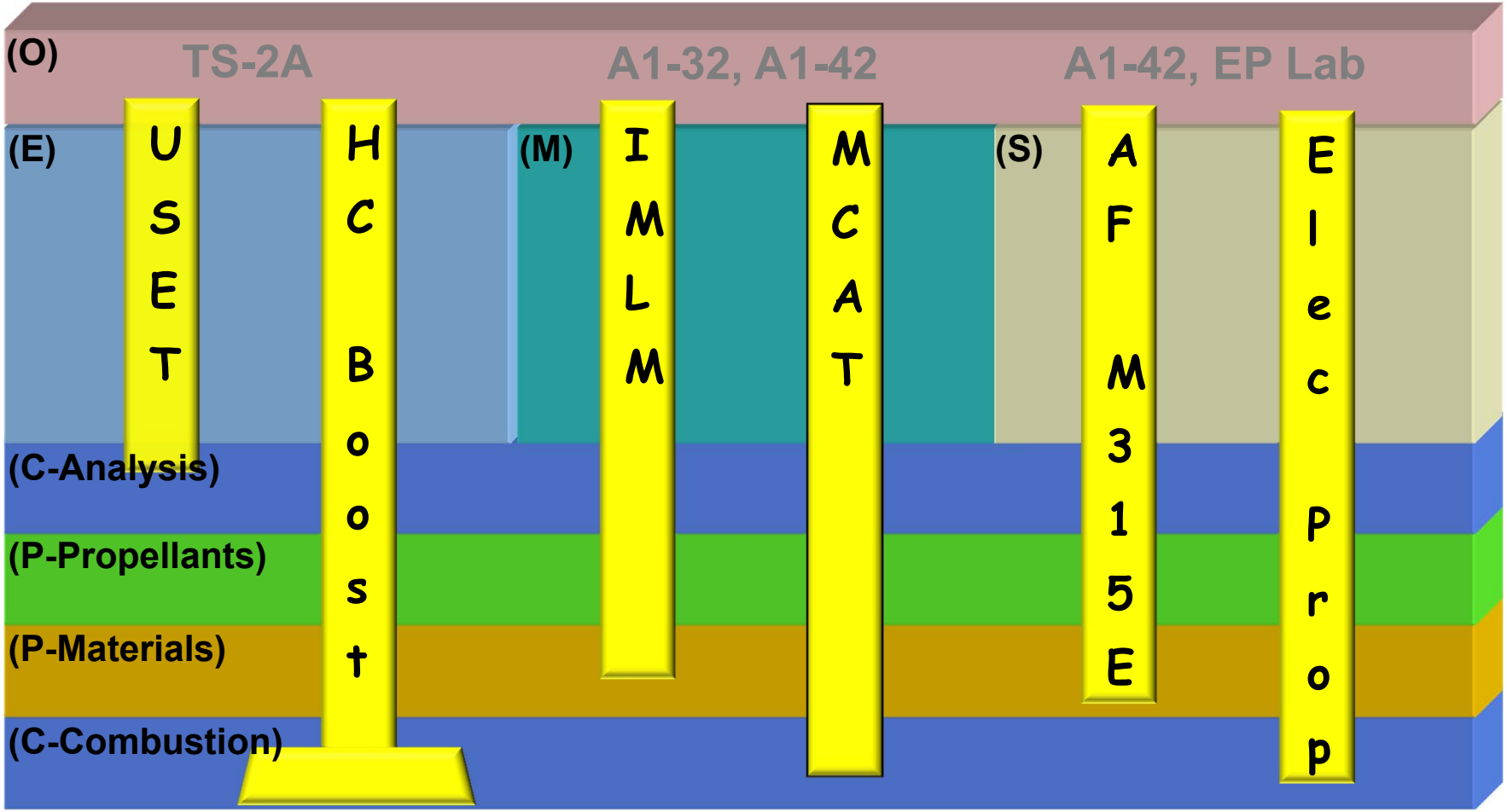
Rocket Propulsion Division (RQR) Functional Layout



Branch Competencies/Expertise

- **RQRC – Combustion Devices**
  - Non-Equilibrium Flows, Fuel Stability, Heat Transfer, High Temperature Components, Propellant Fracture Mechanics, Analysis & Assessment
- **RQRP – Propellants**
  - Liquid &, Solid Rocket Propellant Modeling, Synthesis, Characterization, & Development, Polymers, Propellant Fracture Mechanics
- **RQRO – Experimental Demonstrations**
  - World-Class Facilities & Testing Support For Rocket Propulsion Technologies and Systems. Solids, Liquids, In-Space at Atmospheric or Hi-Altitude (including temp control)
- **RQRM – Motors**
  - Exploratory and Advanced Development of Solid Propulsion Technologies
- **RQRE – Engines**
  - Exploratory and Advanced Development of Liquid Rocket Engine Technologies
- **RQRS – In-Space Propulsion**
  - Exploratory and Advanced Development of Spacecraft Propulsion Technologies

Programs of Interest
(it's all about the paradigm shifts)

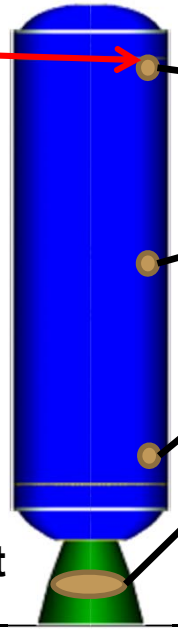


USET – Upper Stage Engine Technology
IMLM – Integrated Motor Life Management
MCAT – Missile Component Advanced Tech

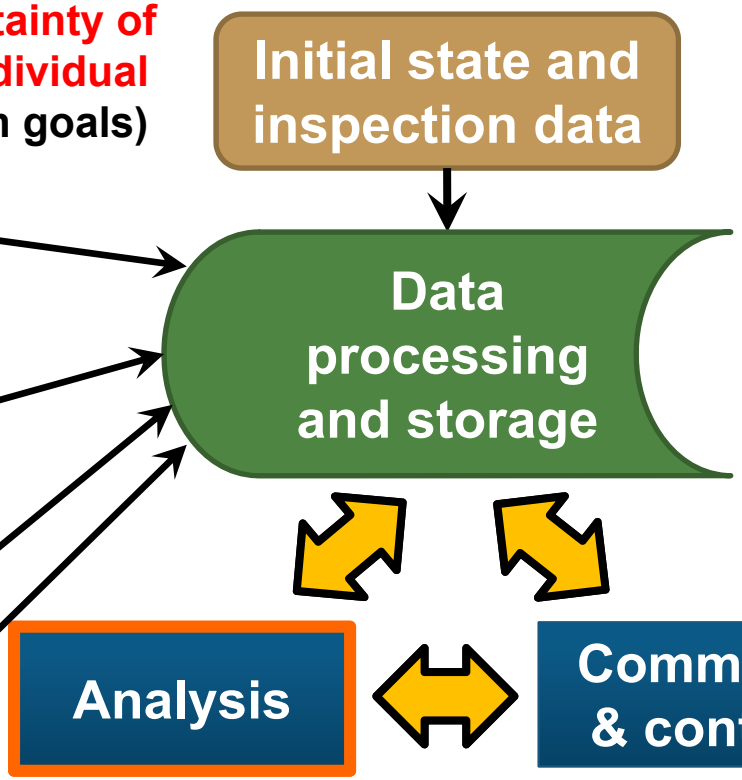
HC Boost – Hydrocarbon Boost
AFM 315E – Green Propellant
EP – Electric Propulsion

IMLM
(Integrated Motor Life Management)

Goals: Reduce predictive uncertainty of future state of a motor on an individual basis by 20%/50% (near/far term goals)



Sensors to include: temperature, humidity, case damage, propellant slump, acceleration, and TVA displacement and load



First integration of motor specific sensor data to advanced aging models to provide a individualized service life estimate

In-House:
- Validation of A&S modeling capability
- AFNWC funded supported for ANDES improvement (Automated NDE Data Evaluation System)

The WOWs
- Potential to provide millions in cost avoidance
- Provide accurate, near-real-time motor health condition (diagnostics)
- Provide individualized service life estimates (prognostics)
- Transition opportunity ~ 2018

MCAT
(Motor Component Assessment Technology)

What are we doing? Developing new solid rocket motor (SRM) components and M&S tools that decrease inert weight by 20%.

Customer why? High-speed penetrator weapons will enable attack of deeply-buried targets.

Tech Reason? New M&S tools may show possibility of higher efficiencies from SRM designs.

Transition? 3 of 6 FY12 task orders support an AFRL FCC. 1 of 6 FY12 task orders supports AFNWC.

In-House:
Experiments to validate new models

The WOWs

- **The AFNWC propellant task is part of a plan that may save $2.1B in future acquisition costs.**
- **We are only gov't lab doing solid rocket motor R&D for launch & strategic needs.**

USET
(Upper Stage Engine Technology Program)

- **Validating new suite of LOx/Hydrogen rocket engine M&S tools through heavily-instrumented 4,000 hp, 90,000 rpm turbopump**
- **Risk reduction work ups TRL of components allowing SMC/LR NGE program to enter post-milestone B, saving years on the schedule and $multi-M's in cost**
- **Verify and Validate suite of tools to greatly reduce the amount of physical testing by conducting better M&S during design**
- **NGE with SMC/LR and tools used in current NGE risk reduction work, Hydrocarbon Boost, >45 M&S tool-specific transitions to industry, DOD, NASA**

In-House:

- **Test stand Buildup**
  - **Design of new facility hardware**
  - **Hardware Fabrication**
  - **Hardware Installation**
- **In-house tool validation and verification**
- **On-site rapid data reduction and analysis**

The WOWs:

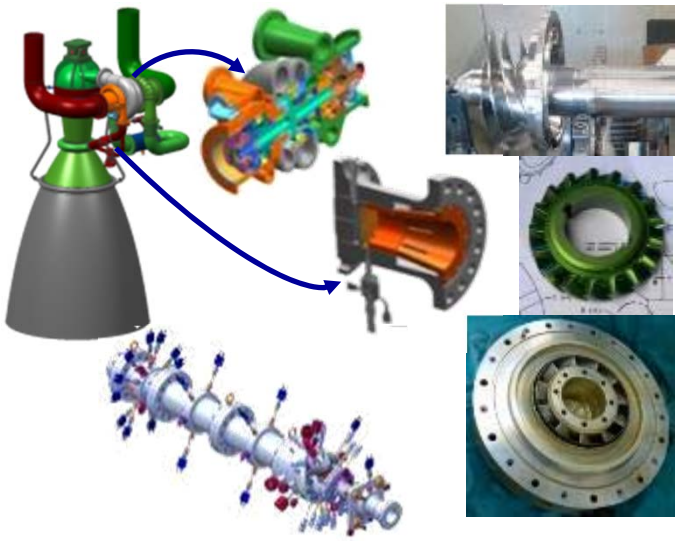
- **SMC/LR requested TTP transition to NGE**
  - **Key member of AUSEP (Affordable Upper Stage Engine Program) IPT**
  - **Conducted Risk Reduction work on USET contract to support AUSEP TRL requirements**
- **Most highly instrumented, highest tip speed and suction of any turbopump ever tested**

SMC/LR AUSEP Vision Engine

Program Completed, Report in Progress

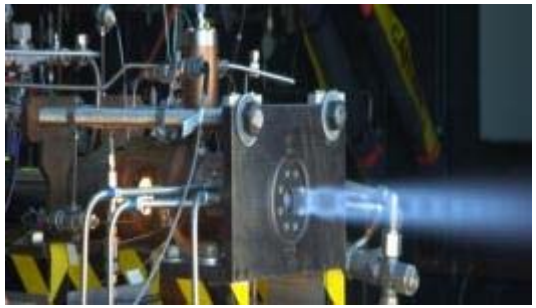
HC Boost
(Hydrocarbon Boost Program)

- HCB establishes advanced, modern, domestic LRE Tech Base
  - Required to replace Russian RD-180 on EELV
  - U.S.'s 1st reusable, high-perf HC engine
  - Establishes Ox-rich staged combustion (ORSC) tech base for U.S.
  - Sustain ailing U.S. rocket engine industry tech development base
  - HCB strongly supports SMC/LR American Kerosene Engine project



In-House:

- Building subscale test facility to mitigate combustion devices risk
- Critical combustion research using 219 funds
- Fuel thermal stability, nozzle cooling, injector design



The WOWs:

- Design, build, test ORSC LOx/Kerosene Liquid Rocket Engine Tech Demonstrator
  - 250K-lbf with high Throttle Capability (SOTA is 2:1) – Enables mission flexibility
  - 100 Life Cycle with 50 cycle overhaul (SOTA is 20) – Exceeds requirement, provides margin
- ORSC is a higher performing engine resulting in a smaller launch vehicle or an increase in delivered payload

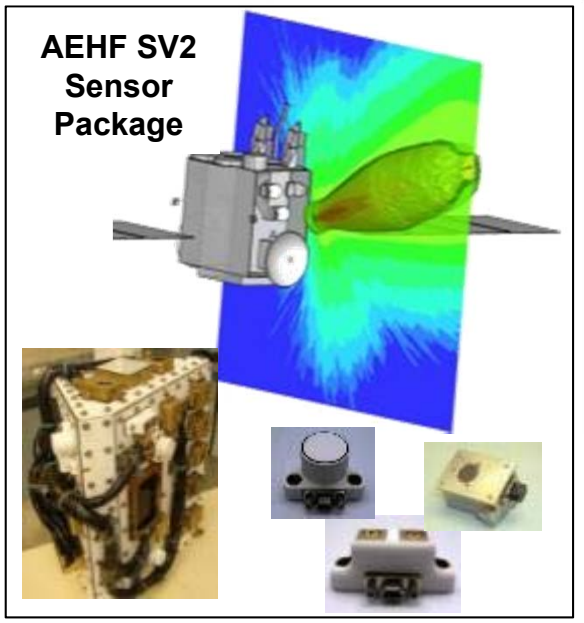
Electric Propulsion

What are we doing? Developing new technologies that enable less expensive, more maneuverable and more agile s/c

Customer Why? Reducing launch mass substantially reduces launch cost, increases payload fraction, and enables missions otherwise not possible (e.g. AEHF)

Tech Reason? Plasma propulsion increases Isp by 10x, reducing s/c propellant 10x, enabling lighter and/or more capable s/c

Transition?
- Tech demos: FalconSat-5–demonstrating low power propulsion and spacecraft impact
- Operational systems: AEHF–enabling high mass spacecraft directly supporting warfighter

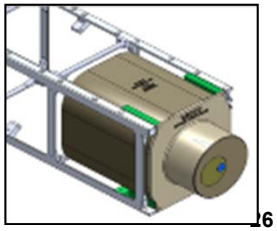


In-House:

- Test facilities
  - 8 vacuum chambers
  - Thruster design
  - Diagnostics
  - Validation of M&S
- Mod/Sim Program
  - Advanced numerical methods

The WOWs:

- AEHF requested assistance with thruster performance verification; SV-2 onboard diagnostics package flying
- Developed propulsion module for FalconSat-5 tech demo, including spacecraft interaction diagnostics
- Cubesat EP propulsion module selected by 2 constellations for flight in 2014
- National M&S effort for EP coordinated by AFRL-RZSS



AFRL Developed Advanced Monopropellants

What are we doing? ***Providing advanced propellant with higher performance and much lower toxicity than hydrazine***

Customer why? ***Faster operational response with reduced costs can be attained with greater mission capabilities***

Tech Reason? ***Energetic ionic liquids provide low vapor toxicity and high energy density***

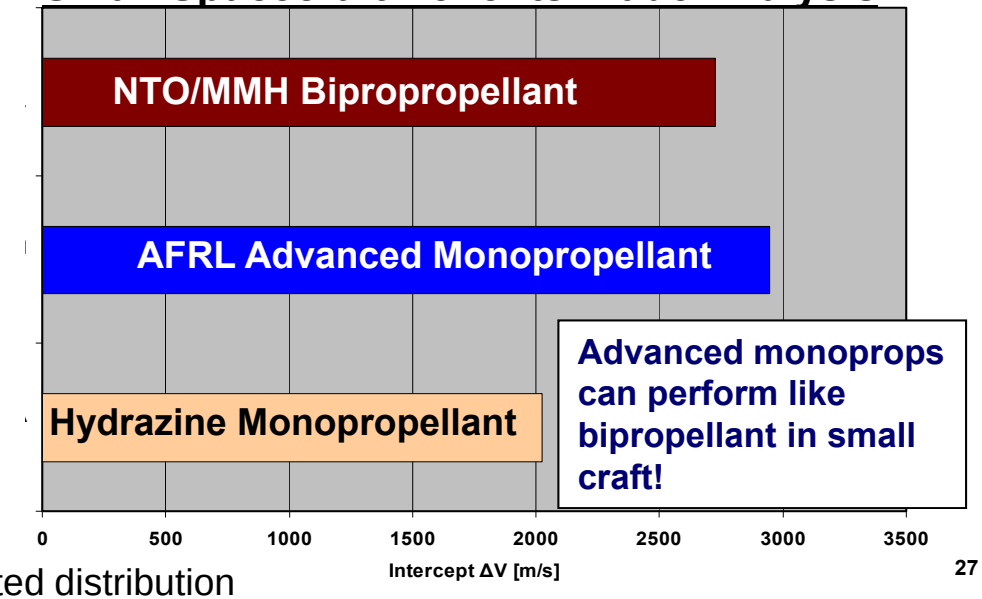
Transition? ***Orbital flight experiment on TBD S/C-2014***

1N – 12N N_2H_4 Thrusters

In-House:

- **Fully characterized small scale safety & hazard properties**
  - **Passes all safety requirements**
  - **DOT approval for transport**
- **First successful thruster firings**
- **Pilot scale propellant production**
  - ***Advanced monopropellant cost = hydrazine cost***
  - **Supplying transition programs**

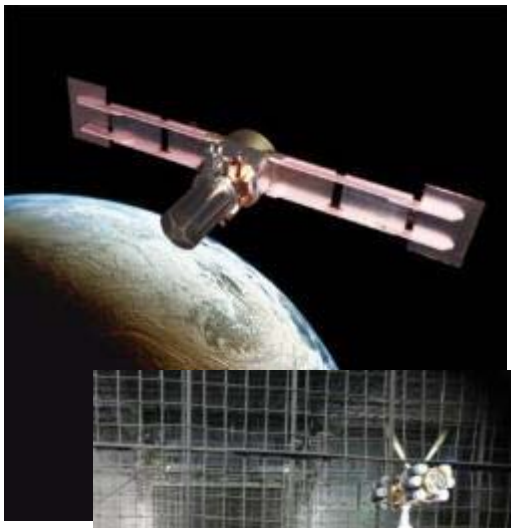
Small Spacecraft Benefits Trade Analysis



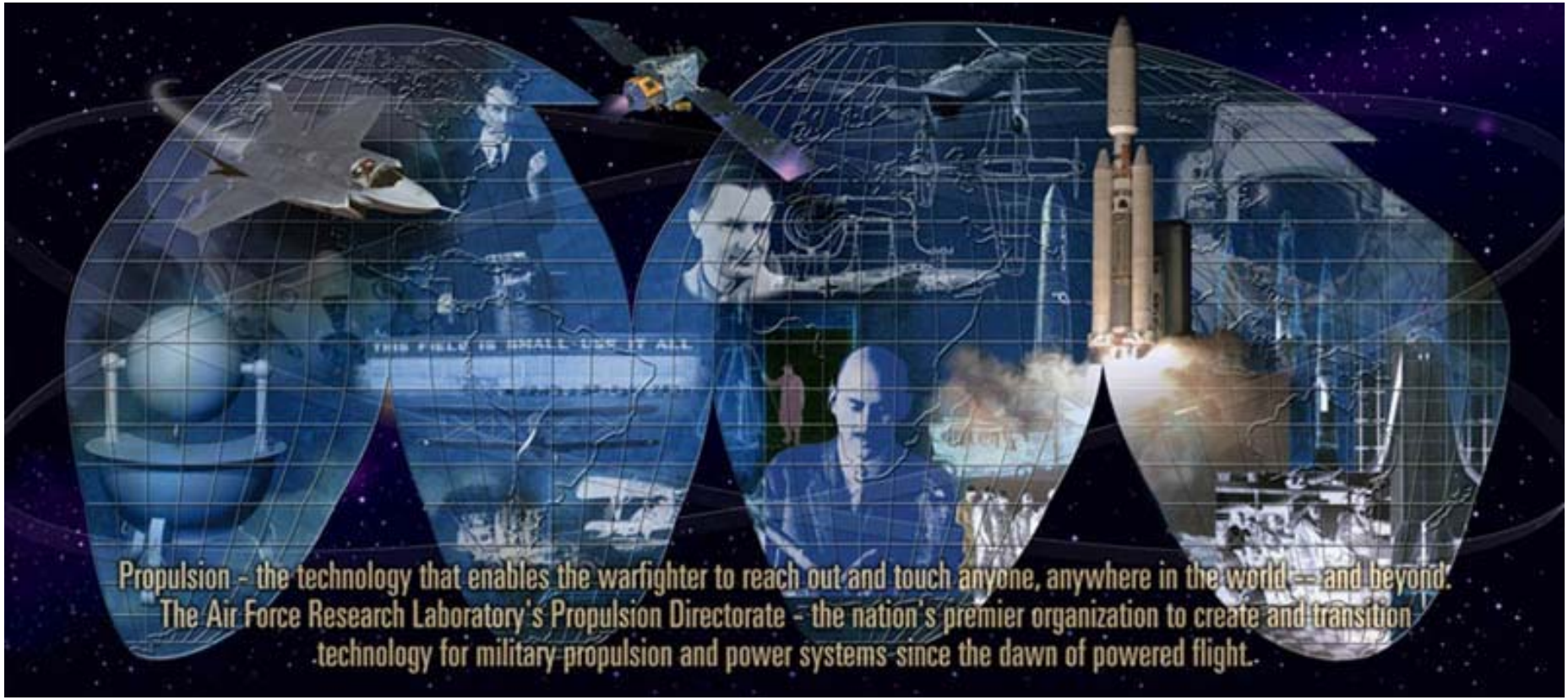
What Have We Done Lately?

Recent Technical Achievements

- Transitioned 200W Hall Thruster to TacSat-2
- Delivered 8 CubeSat thrusters to NRO (10x inc in performance
- USET demo (liquid rocket engine turbopump), M&S transitions & tech transition to customer
- Hydrocarbon Boost subscale preburner on test stand (testing to begin CY14)
- Combustion Stability Test Rig/Facility passed last hurdled, testing to begin this quarter (219 funded)
- New energetic ingredient (furazan class) cleared for large batch (10 lb) scale-up



Questions?


Propulsion - the technology that enables the warfighter to reach out and touch anyone, anywhere in the world -- and beyond.
The Air Force Research Laboratory's Propulsion Directorate - the nation's premier organization to create and transition
technology for military propulsion and power systems since the dawn of powered flight.

ASTROS Project Manager

Jamie Malak

Contract History

- **Research Operation Support Services (ROSS I & II)**
  - **Combined three contracts**
    - **Operational Services Support (OSS)**
    - **Technical Services Support (TSS)**
    - **Facility Support Maintenance Services (FSMS)**
  - **15 year history**
    - **ROSS I, $142M, PoP 1999 - 2011**
    - **ROSS II, $118M, PoP 2011 - 2016**
  - **Competitive source selections**
  - **CPAF**

Meeting Objectives

- **Objectives of Industry Day**
  - **Present proposed program**
    - **Goals**
    - **Schedule**
    - **Seek input for acquisition strategy**
  - **Provide details on Request For Proposals (RFP)**
  - **Gain concurrence/feedback from industry on this plan.**
  - **Send feedback to email addresses listed at www.fbo.gov**
  - **Q & A responses will be posted under FA9300-15-R-0001 in FBO NLT 27 July 2014**

Business Overview

Contracting Presenter

Aimee Helm

Contracting Overview

- Current Contract
- Requirements to do Business with the Government
- Acquisition Background
- Contract Type
- Contract Structure
- Acquisition Conditions
- Oversights
- Deliverables
- Tentative Contracting Milestones
- Base Support/Government Furnished Services
- Organizational Conflict of Interest
- Source Selection

Current Contract

- **ROSS II, FA9300-11-C-0001**
- **Current Contractor: Jacobs Technology Inc.**
- **Contract Type: CPAF, FFP, CPFF**
- **Original Total Contract Value: $86M**
- **Current Contract Value: $118M**
- **NAICS Code: 541712 - Research and Development in the Physical, Engineering, and Life Sciences (Except Biotechnology)**
  - **SB size standard 1000 Employees**

Requirements to do Business with the Government

- **System for Award Management (SAM) required in accordance with FAR 4.1102. Access at: https://www.sam.gov/portal/SAM#1**
  - **Core Data (formerly Central Contractor Registration or "CCR")**
  - **Representations & Certifications (formally Online Representations and Certifications or "ORCA")**
- **Wide Area Work Flow(WAWF): Contractors will submit payment requests in accordance with the instructions contained in their specific contract. Reference DFARS 252.232-7003. Contact your particular DCMA office for training. Access at: https://wawf.eb.mil/**

Acquisition Background

- **Project Name: ASTROS**
- **On Site Support – AFRL/RQ- West**
- **Anticipated Period of Performance, 10 years**
  - **4 Year Basic**
  - **2 Year Award Term**
  - **2 Year Award Term**
  - **2 Year Award Term**

Tentative Contract Type

- **Cost-Plus-Fixed-Fee + Performance Incentive + Award Term**
  - **CPFF (X%)+ PI (X%), request Industry input**
    - **Possible Performance Incentive Criteria**
      - **Management**
      - **Technical**
      - **Cost**
      - **Schedule**

Anticipated Contract Structure

- **Basic contract CLIN structure**
  - **CLIN 0001** — **Phase In (FFP)**
  - **CLIN 0002** — **ASTROS Labor (CPFF + PI)**
  - **CLIN 0003** — **Materials and Travel (Cost), government provided amount**
  - **CLIN 0004** — **CDRLs (NSP)**
- **Award Term Periods CLIN structure**
  - **CLIN X002** — **ASTROS Labor (CPFF + PI)**
  - **CLIN X003** — **Materials and Travel (Cost), government provided amount**
  - **CLIN X004** — **CDRLs (NSP)**

Acquisition Conditions

- Security classification
- Base support
- Computer security requirements
- No foreign participation
- International Traffic in Arms Regulations (ITAR)
  - Public Law 98-94 (Export Control)
- Organizational Conflict of Interest (OCI)
- Non Disclosure Agreements (NDA)
- Associate Contractor Agreements (ACA)
- Unlimited data rights
- Environmental and safety requirements
  - Hazardous materials

Potential Oversight

- **Monthly Management In-House Reviews**
- **Regular updates to Government Program Manager and Work Plan Manager**
- **Compliance with Service Summaries**
- **Performance Incentive Reviews – fee**
- **Award Term Board – added years**

Potential Deliverables

- **Work Plan, as required**
- **Monthly Funds and Man-Hour Expenditure Report**
- **Property Control Plan**
- **State Environmental Health and Safety Plan**
- **Subcontracting Plan**
- **Quality Control Plan**
- **Instrumentation Controls Software/Programming**

Organizational Conflict of Interest

- **Per Policy Memo 10-C-15 (15 Oct 2010) directed at AFFARS 5352.209-9000:**
  - **Prevents conflicting roles which may bias the contractor's judgment of objectivity, or to preclude the contractor from obtaining an unfair competitive advantage in concurrent or future acquisitions.**
  - **Alt III – May not use other company's proprietary information in any other way or purpose**
  - **Alt VI – Restrictions are binding to any subcontractors – prime must include in any subcontracts**
  - **Both Alts apply to this contract**
- **Policy Memo 10-C-15 can be found at**
  - **http://ww3.safaq.hq.af.mil/shared/media/document/AFD-101018-008.pdf**

Tentative Contracting Milestone

• RFP release	Apr 2015
• Proposals due	Jun 2015
• Proposal evaluation	Jun-Oct 2015
• Contract Award	Dec 2015
• Phase- In (60 days)	Jan 2016
• Full Performance	1 Apr 2016

Base Support

- Office space, furniture, telephones, computers
- Emergency medical transport
- Security police support
- Firefighter support
- Site specific training (i.e. Desert Tortoise)
- Custodial Service
- Use of government fuel supply

Tentative Source Selection

- **Award based on Best Value**
- **Evaluation factors**
  - **Factor 1: Mission Capability**
    - **Subfactor 1: Technical scenarios**
    - **Subfactor 2: Program management**
    - **Subfactor 3: Subcontract management**
    - **Subfactor 4: Personnel recruitment and retention plan**
  - **Factor 2: Past Performance**
  - **Factor 3: Cost/Price**
- **Factor 1 is most important. Factors 2 and 3 are equal in importance and of lesser importance than Factor 1.**
  - **Factor 1 >(Factor 2 = Factor 3)**

Tentative Source Selection

- **Written & Electronic Proposals**
  - ➢ **Electronic spreadsheets must include formulas**
- **Oral Presentations**
  - **15 minutes company description/capabilities**
  - **45 minutes evaluated**
  - **Factor 1, subfactors 2, 3 and 4**

Technical Overview

Technical Presenter

Robert Shah

Technical Overview

- **Current Demographics**
- **Major Work Vectors**
- **Contract Management**
- **Security / ITAR Restrictions**

Current Technical Demographics

- **Total number: 95**
- **Skill Sets Include**
  - **Scientists / Engineers (38)**
  - **Technicians (57)**
    - **Mechanics**
    - **Instrumentation and Controls**
    - **Machinists**
    - **Welders**
    - **Electricians**

Major Vectors

- **Provide comprehensive program management responsible for overall program coordination and all individual tasks required to satisfy assigned mission on time and at or under agreed budget**
- **Provide appropriate specialized skills related to rocket propulsion systems. Demonstrate flexibility to quickly respond to changing test stand build up requirements and priorities**
- **Provide robust, timely and accurate standardized electronic billing and purchasing systems at the CLIN/ACRN/Task level, linking PO & invoice (with % Davis Bacon Act)**
- **Maintain required safety, security, quality, code/regulation/logistics compliance and sustainability levels**
- **Maintain required configuration management such as drawings, SOPs, etc.**

Security

- **Work site is in an access controlled area**
  - **Badges required**
  - **Military base requirements**
  - **Special requirements for visitor access**
- **Some classified information may be generated**
- **No POVs in test areas**
- **Comply with International Traffic in Arms Regulations (ITAR) and EAR (Export Administration Regulations) as such items are generated**

Security (cont.)

- **All documents must be reviewed and approved by the Scientific and Technical Information Office (STINFO) prior to release. A vast majority of documentation generated will have limited distribution**
- **Contractors have a responsibility to inform their subcontractors and commercial suppliers that they must also comply**
- **For further information, please reference:**
  - **ITAR, 22 CFR 120-130, http://www.pmddtc.state.gov/regulations_laws/itar.html**
  - **EAR, 15 CFR 730-774, http://www.access.gpo.gov/bis/ear/ear_data.html**

Questions & Discussion

Agenda

0800 – 0815	Meet and Greet Social
0815 – 0845	Edwards Research Site Overview
0845 – 0900	Identification of Key AF Personnel
0900 – 0915	Business Information
0915 – 0930	Break
0930 – 1000	Technical Information
1000 – 1030	Q&A
1030 – 1100	Tour 1/Individual Q&A Sessions
1100 – 1200	Lunch
1200 – 1230	Tour 2/Individual Q&A Sessions
1230 – 1500	Individual Q&A Sessions (as needed)